

# 2000 Energy Efficiency Activities in Massachusetts

## Division of Energy Resources Commonwealth of Massachusetts *Office of Consumer Affairs and Business Regulation*

### Introduction

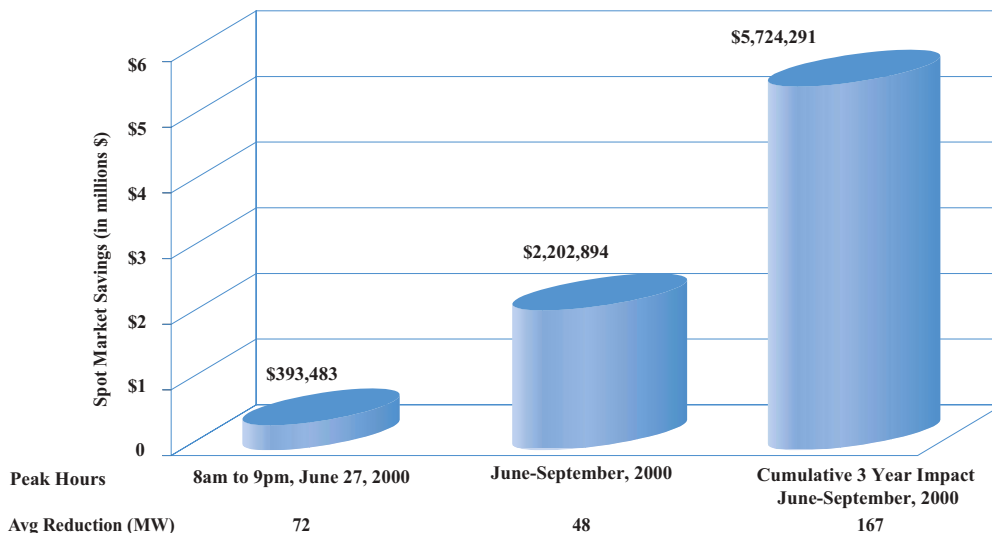
Massachusetts law requires customers of electric distribution companies to contribute a portion of their electricity charges to support activities that reduce electricity consumption. Enacted as part of the 1997 Electric Industry Restructuring Act ("the Act"), the policy recognizes that energy efficiency investments can: lower the overall cost of electricity without reducing comfort or convenience, lower the emission of harmful air and water pollutants, create jobs, and stimulate the economy. The investments provide for the installation of high efficiency lighting, motors, air conditioners and appliances; the construction of high efficiency homes and commercial buildings; and more.

This summary provides an overview of the Division of Energy Resources' ("the Division") third annual legislative report on the status of ratepayer-funded energy efficiency activities in the Commonwealth, and the extent to which the statewide energy efficiency goals are being met (see pg. 8).

### 2000 Highlights

- ❖ *Energy efficiency programs improved reliability and lowered wholesale electricity prices through demand reduction by nearly \$6 million in 2000.*
- ❖ *Participants saved over \$19 million on their 2000 electric bills.*
- ❖ *These bill savings are projected to grow to approximately \$295 million over the lifespan of the installed measures.*
- ❖ *Participating customers and ratepayers invested \$168 million in 2000 to achieve the savings.*
- ❖ *The cost to conserve electricity is 55% less than the cost to buy it over the life of these energy efficiency measures.*

**Figure 1: Potential Impact of Demand Reductions  
on the Wholesale Energy Spot Market**

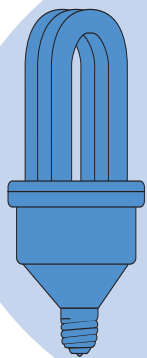


Source: Division of Energy Resources

## Energy Efficiency Investments Improved Reliability and Lowered Wholesale Electricity Prices

By reducing demand during peak usage periods, energy efficiency programs contribute to system reliability in terms of supply adequacy within a particular area or region and can enhance reliability of local transmission and distribution networks. This is especially important in Massachusetts where there is constrained transmission into areas in and around Boston and the Cape and Islands. By reducing load and demand on the power distribution network, energy efficiency programs decrease the costly likelihood of system failures. The programs also help avoid higher wholesale energy clearing prices. The Division estimates, for example, that on June 27, 2000, energy efficiency programs reduced demand by

### What is Energy Efficiency?



Energy efficiency is the implementation of an action, policy or measure, which entails the application of the least amount of energy required to produce a desired or given output and includes demand-side management and energy conservation measures. Improvements can include replacing equipment, such as lights, motors, appliances, and air conditioners with more efficient electrical equipment. Increased energy efficiency can also be realized through changes in behavior, such as turning off or dimming lights, and raising air conditioning thermostats (or lowering heating thermostats) in unused spaces.

an average of 72 MW over a 13-hour peak period. This demand reduction saved nearly \$400,000 in additional wholesale electricity costs to the system – costs that would likely have been passed on to all customers (see Figure 1). Further, about \$2.2 million in additional costs were avoided over the peak summer months (June to September) despite the relatively mild conditions and moderate demand in electricity prices. When considering the cumulative demand reduction impact in 2000 from energy efficiency measures installed over the period 1998 to 2000, the Division estimates total savings of \$5.7 million. These estimates, which reflect savings associated with the spot market load only, are considered conservative. Over time, there is an additional impact on the remainder of the energy market operating on bilateral contracts, because bilateral market prices directly depend on spot energy prices. This broader impact increases system savings significantly.

### Residential Customer Improves Efficiency of Home

**Customer/Location:** Mr. Shawn Battle, East Pepperell (single-family home)

**Program:** Massachusetts Electric Company's Residential EnergyWise Program

**Efficiency Activities:** Provided complete home analysis, appliance education package, and individualized report on electric use. Applied comprehensive air sealing using a blower door and other diagnostic tools, attic insulation. Provided therm dome hatch, floor insulation, automatic setback thermostats, Energy Star fixtures, efficient showerheads and refrigerator brush.

**Total Project Cost:** \$4,165

**Customer Rebate:** \$3,340

**Annual Savings:** 12,828 kWh or \$1,280

**Lifetime Savings:** 256,650 kWh or \$25,600

### 2000 Program Participants Saved Money

Program participants saved over \$19 million on their 2000 electricity bills (see Table 1). Assuming that the energy efficiency equipment installed in 2000 remains in place for its full lifetime (an average of 15 years), total savings are projected to grow to approximately \$295 million. Collectively, participants saved an average of 5% on their 2000 electricity bills.

**Table 1: 2000 Average Bill Impacts from Energy Savings**

Customer Class	Total Annual Bill Reductions for Participants	Avg. Annual Bill Savings per Participant
Low-Income	\$983,045	\$78
Residential	\$5,563,663	\$32
Small C&I	\$1,557,061	\$726
Medium C&I	\$2,408,230	\$1,579
Large C&I	\$8,676,129	\$13,146
Total/Average	\$19,188,128	\$100

Source: Division of Energy Resources

Program participation levels in 2000 varied greatly among the different customer sectors (see Table 2). Low-income customer participation rates were 5%, based on an eligibility threshold of 200% of the Federal Poverty Level. Comparatively, residential participation levels were more than twice that of low-income customers, at 12% of total eligible households. Large C&I customers continue to have a high participation rate, reflecting the fact that large electricity users reap the greatest savings (as a % of their total operating costs) by improving the efficiency of their facilities, and often participate in programs more than once a year. Small C&I customers, and to a lesser extent Medium C&I customers, have the lowest participation rates despite potential bill savings and efforts to target these customers. These lower rates are due to barriers these customers face to investing in energy efficiency, including a lack of energy management resources and interest in reducing energy use.

**Table 2: 2000 Energy Efficiency Program Participation**

Customer Sector	# of Participants	% Served
Low-Income	27,791	5
Residential	188,553	12
Small C&I	2,144	1
Medium C&I	1,525	3
Large C&I	660	12
Total/Average	220,673	9

Source: Division of Energy Resources

**Major Electricity Consuming Equipment**

**Residential:** space heating and cooling, water heating, refrigeration, lighting, and household appliances

**Commercial:** lighting, heating ventilation and air conditioning (HVAC), motors, and refrigeration

**Industrial:** lighting, HVAC, motors, boilers, air compressors, and process equipment

**Energy Efficiency Measures and Controls Installed at the New Cambridge Water Treatment Plant**

**Customer/Location:** Cambridge Water Treatment Plant, Cambridge

**Program:** NSTAR's Electric Company's C&I New Construction Program

**Efficiency Activities:** Provided financial, technical, and engineering assistance, commissioning and post-inspection services. Installed variable frequency drives on water pumps and energy efficient lighting throughout the facility.

**Total Project Cost:** \$519,300

**Customer Rebate:** \$88,060

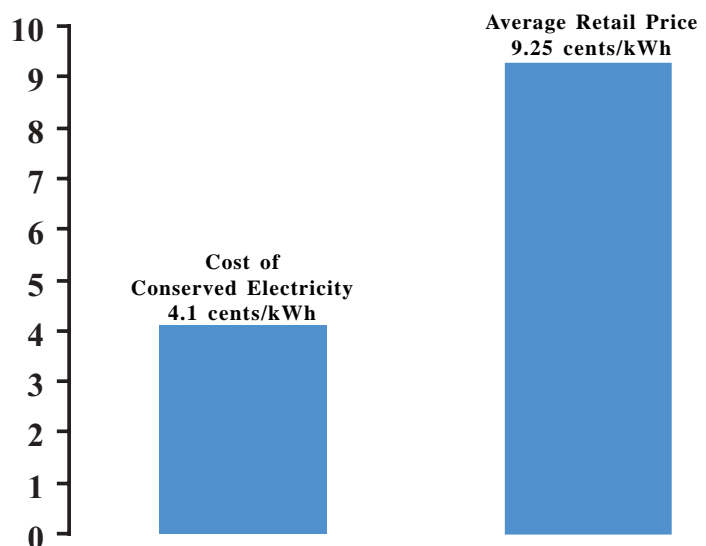
**Annual Savings:** 2,482,999 kWh or \$201,868

**Lifetime Savings:** 37,244,085 kWh or \$3,027,944

**Energy Efficiency is Cheaper than Buying Electricity**

A total of \$168 million was invested in energy efficiency program activities in 2000 (comprised of \$130 million collected from ratepayers and \$38 million contributed by participants). An estimated 4,147 million kilowatt-hours will be saved over the lifetime of the investments. On average, this represents a cost of conserved energy of 4.1¢/kWh for program participants – 55% less than the projected average retail electricity price of 9.25¢/kWh (in nominal dollars) over the same period.

**Figure 2: Cost of Conserved Electricity vs. Average Retail Price**

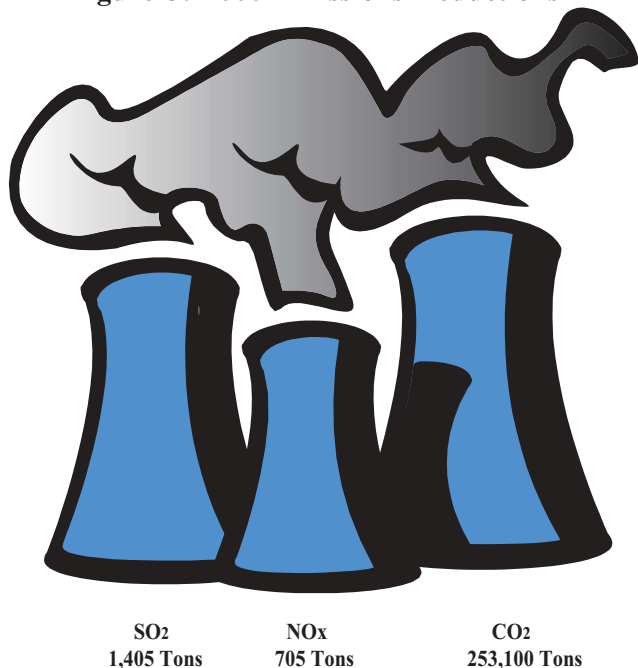


Source: Division of Energy Resources

## Energy Efficiency Programs Improve Air Quality in Massachusetts and the New England Region

In year 2000, ratepayer-funded energy efficiency activities reduced the amount of air polluting emissions released by electricity generating units by reducing electricity demand. While it is difficult to attribute energy efficiency-derived emissions reductions to any specific Massachusetts generating facility, overall emissions by the regional power system were reduced. The annual emission reductions for the three most critical pollutants – nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and carbon dioxide (CO<sub>2</sub>) – were 705 tons, 1,405 tons, and 253,100 tons, respectively. The NO<sub>x</sub> emission reductions are roughly equivalent to the annual emissions of 53,410 passenger cars. The SO<sub>2</sub> emission reductions are equivalent to avoiding the burning of 100,030 tons of bituminous coal, the primary type of coal burned for electricity generation. The 253,100 tons of reduced CO<sub>2</sub> emissions are equivalent to the annual emissions of 50,855 cars and light vehicles. The Division further estimates that over the lifetime of energy efficiency measures installed in 2000, emission reductions for these pollutants will be 6,558 tons, 9,086 tons, and 2,042,400 tons, respectively. Thus, the air quality benefits from 2000 energy efficiency activities will continue over the long-term.

**Figure 3: 2000 Emissions Reductions**



Source: Division of Energy Resources

### *New Central Vacuum System Results in Sizable Savings for Plastics Manufacturer*

**Customer/Location:** PolyMatrix, Pittsfield  
**Program:** Western Massachusetts Electric Company's Custom Services Program  
**Efficiency Activities:** Analyzed energy conservation opportunity. Installed central vacuum system to hold and transfer plastic components during manufacturing, reducing horsepower need by 25%.  
**Total Project Cost:** \$37,170  
**Customer Rebate:** \$18,192  
**Annual Savings:** 124,656 kWh or \$7,900  
**Lifetime Savings:** 1,869,840 kWh or \$118,500

## Creating Jobs in the Commonwealth

Energy efficiency activities promote the expansion of Massachusetts energy efficiency industries and other industries in the state. For example, the Division's economic model estimates that year 2000 ratepayer-funded investments in energy efficiency will create 1,183 new jobs in Massachusetts, contributing \$73 million to the gross state product. In addition, \$48 million in disposable income will be gained over the next decade from these jobs, most of which will be realized in the short-term. These jobs are concentrated in the services, retail trade and manufacturing sectors.

### *Grammar School Improves its Building's Efficiency\**

**Customer/Location:** DeValles Grammar School, New Bedford  
**Program:** NSTAR's Electric Company's Small C&I Program (an economic development project)  
**Efficiency Activities:** Re-lamped and re-ballasted fixtures, retrofitted all exit signs with new LED exit signs.  
**Total Project Cost:** \$11,149  
**Customer Rebate:** \$11,149  
**Annual Savings:** 67,125 kWh or \$8,055  
**Lifetime Savings:** 1,006,875 kWh or \$120,825

*\*A portion of 2000 energy efficiency programs targeted economic development projects throughout the state. In these projects, customers received 100% rebates to improve the efficiency of their facilities or operations. DeValles Grammar School is an example of such a project.*

## Program Cost-Effectiveness Improved in 2000 Due to Changes in Methodology

According to the methodology for determining program cost-effectiveness [as approved by the Department of Telecommunications and Energy (“the Department”)], year 2000 ratepayer-funded programs were cost-effective with an overall benefit-cost ratio of almost 2 to 1. This ratio measures the value of energy efficiency program savings compared to the associated program costs from a total resource perspective. Specifically, benefits are the value of wholesale electricity, and distribution and transmission costs avoided by distribution companies, as well as other resource and non-resource benefits due to program savings over the lifetime of year 2000 installations. Costs are those expended on program activities in year 2000, including participant costs.

Program cost-effectiveness increased relative to 1999 as a result of revisions to the Department’s methodology for quantifying other energy and non-energy benefits of programs. Beginning in 2000, the Department allowed a more comprehensive counting of benefits and costs, pursuant to its 98-100 Order. These additional benefits include increased worker productivity and property improvement for homeowners and businesses due to the installation of higher efficiency equipment. Moreover, energy efficiency investments save distribution companies money by reducing costs related to bad debt expenses and other costs that would otherwise be passed on to all customers. Further, customers accrue other resource savings such as reduced natural gas and water bills. For example, the investment in an energy efficient clothes washer will not only reduce electricity costs to wash the clothes, but will also reduce water use and if applicable, the gas used to heat the water.

### *Partnership with Boston Housing Authority Promotes Energy Efficiency in Public Buildings*

**Customer/Location:** Boston Housing Authority  
(six facilities)  
**Program:** NSTAR’s Electric Company’s C&I Retrofit Program  
**Efficiency Activities:** Installed energy-efficient lighting, windows and motors. Tested indoor air quality and occupant comfort.  
**Total Project Cost:** \$1,350,410  
**Customer Rebate:** \$1,311,530  
**Annual Savings:** 2,770,365 kWh or \$225,231  
**Lifetime Savings:** 41,555,475 kWh or \$3,378,460

Additionally, the Department’s 98-100 Order directed that, beginning in year 2000, the value of “post program effects/savings” be considered in program cost-effectiveness analyses for market transformation programs (see pg. 6: *Program Activities Balance Short and Long-Term Savings*). These savings are expected to accrue to customers over the long-term after these programs end (i.e., due to the programs transforming the market for a particular technology). Initial estimates of post program savings show substantial increases in program cost effectiveness. These estimates are subject to further review by the Department.

## Summary of Energy Efficiency Funds Collected and Expended

A total of \$126.5 million was collected from ratepayers during 2000 to support energy efficiency activities. This represents an average of 3% of customers’ average annual electricity charges. In addition, \$25.8 million of unspent funds in 1999 were carried forward to 2000 program budgets, providing a total of \$152.4 million in Total Available Funds for 2000. Total expenditures for the year were \$130.5 million, leaving a year-end fund balance of \$21.9 million. Over half of this balance represents committed funds set-aside to pay for energy efficiency service contracts that will be paid in future years as actual savings occur. The remainder of the year-end fund balance was attributable to higher actual sales than forecasted sales (which were used to develop program budgets), thus producing a surplus of funds. Also, a portion of the 2000 fund balance was committed to energy efficiency projects but not yet expended at year-end. Unexpended funds in 2000, plus interest, were carried forward to 2001. The Division anticipates that the 2000 fund balance and year-end balances for 2000 and 2001 will be committed to specific energy efficiency projects by year-end 2002.

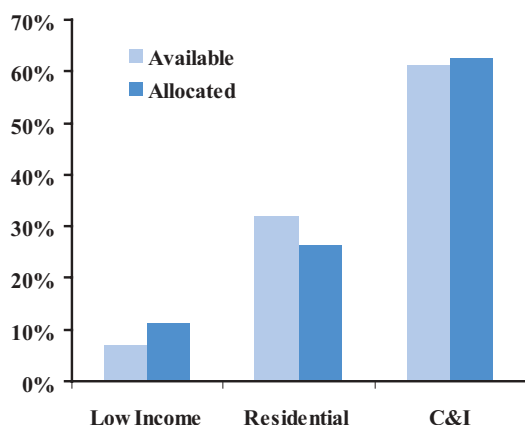
## Residential Sector Subsidizes Other Customer Sectors

The Act directs the Division to ensure that ratepayer funding for energy efficiency is equitably allocated among customer sectors. Equitable allocation is influenced by a specific requirement of the Act with respect to low-income customers. Specifically, the Act directs that low-income program funding levels be at least 20% of the amount expended for residential programs, and no less than \$0.00025 per kWh (based upon total kWh sold to all customers). In its analysis, the Division uses the federal weatherization program standard of 200% of the Federal Poverty Level to define the low-income sector.



Available funds in year 2000 for the low-income, residential, and C&I sectors were 7%, 32%, and 61%, respectively, while funds were allocated 11%, 26%, and 63% respectively. Comparing Available Funds to Allocated Funds (see Figure 4), shows that program expenditures for the residential sector were 6% less than expected given the amount of Available Funds designated for that sector. Low-income energy efficiency activities accounted for 4% of the 6% shortfall, while the balance (or 2%) subsidized the C&I sector. The Division is working with Program Administrators (i.e., distribution companies) and key stakeholders to identify and target energy efficiency investment opportunities for the residential (non-low-income) sector so that funds are more equitably allocated across all sectors.

**Figure 4: 2000 Available vs. Allocated Funds**



Source: Division of Energy Resources

Note: "Available Funds" refers to 2000 collections from customer sectors and carry over funds from 1999. "Allocated Funds" refers to 2000 expenditures plus year-end balances.

### Program Activities Balance Short and Long-Term Savings

Ratepayer-funded energy efficiency programs served two fundamental purposes in 2000: they provided immediate savings for participating customers, while also laying the foundation for long-term savings for all customers by transforming energy efficiency markets.

Of the \$130.5 million spent on energy efficiency activities in year 2000, the greatest portion (\$77.3 million) was invested in Retrofit programs. These programs encourage

#### *Low-Income Customer Participates in Retrofit Program*

**Customer/Location:** Ms. Kristine Arsenault  
**Program:** Fitchburg Gas & Electric Company's Low Income Efficiency Program  
**Efficiency Activities:** Installed DHW pipe insulation, low-flow showerheads, faucet aerators, air sealing, compact fluorescent lamps, and an energy efficient refrigerator.  
**Total Project Cost:** \$1,599  
**Customer Rebate:** \$1,599  
**Annual Savings:** 3,166 kWh or \$355  
**Lifetime Savings:** 47,490 kWh or \$5,319

the replacement of outdated and inefficient electrical and/or mechanical equipment, such as lighting, heating and cooling systems, motors, energy management systems, and process redesign/improvements. Financial rebates are employed to persuade customers to upgrade to higher efficiency equipment.

The second largest portion of funding (\$31.9 million) was spent on Lost Opportunity/New Construction programs. These programs focus on encouraging investment in higher energy efficiency at the time of a naturally-occurring market event such as construction of a new home or building, major expansion, renovation or remodeling, or replacement of failed equipment. These programs not only provide immediate and long-term savings to participants through rebates, but also target key market players (e.g., architects, designers, and builders) in order to change standard building practice and to upgrade building codes and standards, benefiting all customers over the long-term.

#### *Energy Efficiency Project Helps Commercial Customer Adopt Innovative Design*

**Customer/Location:** Parlex Corp., Methuen  
**Program:** Massachusetts Electric Company's Energy Initiative Program  
**Efficiency Activities:** Performed metering study on existing process chiller and proposed more efficient design by installing plate heat exchangers that use city water to pre-cool the water.  
**Total Project Cost:** \$74,106  
**Customer Rebate:** \$37,053  
**Annual Savings:** 166,788 kWh or \$11,759  
**Lifetime Savings:** 2,189,000 kWh or \$154,325

Over 10% of expenditures (\$14.5 million) was spent on Regional Market Transformation programs. These programs are typically implemented on a joint or coordinated basis by the Program Administrators in Massachusetts, and often involve coordination by the Northeast Energy Efficiency Partnership. While these programs provide some immediate savings to participating customers, more importantly, they aim to change the production, purchasing, design, and stocking practices of manufacturers, builders, engineers, architects, and retailers over the long-term. By changing the fundamental behavior of these market players, these programs improve long-term efficiency on a much larger scale than programs that focus on changing the behavior of end-use customers.

The remainder of year 2000 expenditures (\$6.8 million) focused on educational programs for residential customers and interruptible credit programs for C&I customers.

*Massachusetts ENERGY STAR  
Home "Builder of the Year" Award*

**Customer/Location:** DiPlacido Development Corp., Wampanoag Estates in Wrentham

**Program:** ENERGY STAR Homes Program, Massachusetts Electric Company

**Efficiency Activities:** Built 18 single family new homes between 2500-3500 sq. ft. with high efficiency gas furnaces, R-30 basement/ceiling insulation, advanced air-sealing package, duct sealing, setback thermostats, and ENERGY STAR appliances.

**Total Project Cost:** \$31,500 (incremental)

**Customer Rebate:** \$9,200

**Annual Savings:** 7,825 kWh or \$6,603

**Lifetime Savings:** 268,000 kWh or \$227,355

### **The Competitive Market for Energy Efficiency Services Contracts**

One indication of whether the competitive market for energy efficiency services has developed in Massachusetts is to observe the extent to which competitive retail suppliers provide customers with products and services. As was the case in 1999, the Division continues to observe a lack of energy efficiency services offered by competitive retail suppliers due to limited activity in the retail electricity market in general.

However, another measure of competition in the energy efficiency market is the extent to which ratepayer-funded program services (e.g., program implementation) are competitively procured. The Act requires that competitive procurement processes be used to the greatest extent practicable when delivering programs to Massachusetts customers. These procurement processes benefit customers by providing lower, competitively set program costs, as well as by introducing innovative elements to program designs and/or implementation. In 2000, 73% (or \$95.3 million) of total energy efficiency expenditures was competitively procured outside of the administering distribution company. This level of competitive procurements was consistent with levels in prior years.

### **Conclusions**

The Division concludes that 2000 energy efficiency program activities continue to effectively address the statewide energy efficiency goals. They provided:

- ❖ **Savings for all customers in the form of avoided costs to the distribution companies over the long-term,**
- ❖ **Reduced wholesale energy prices in the short-term, costs that would ultimately be paid for by customers,**
- ❖ **New jobs in the state, and;**
- ❖ **Reduction in harmful emissions from fossil-fueled power plants, thus helping to improve air quality.**

These direct and indirect impacts of the energy efficiency programs continue to benefit the Commonwealth's economy and its citizens.

For further information on 2000 energy efficiency activities, please refer to the full report that can be found at the Division's web site: <http://www.mass.gov/doer>.

**Massachusetts Overall Energy Efficiency Goal:**

Strengthen the economy and protect the environment by increasing the efficiency of energy use.

**Energy Efficiency Operational Goals:**

- 1) Reduce the use of electricity cost-effectively pursuant to DTE directive.
- 2) Ensure that energy efficiency funds are allocated to low-income customers consistent with the requirements of the Act, and allocated equitably to other customers classes.

**Energy Efficiency Programmatic Goals:**

- 3) Reduce customer energy costs by balancing short-run and long-run savings from energy efficiency programs.
- 4) Support the development of competitive markets for energy efficiency products and services.

**This Executive Summary and the full 2000 Energy Efficiency Report  
are available at DOER's web site.**

**<http://www.mass.gov/doer>**

**Suggestions and comments can be mailed to  
[doer.energy@state.ma.us](mailto:doer.energy@state.ma.us)**

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The DOER report is a publication of the Commonwealth of Massachusetts  
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